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SOCIAL SCIENCES

U. S. TREASURY DEPARTMENT
HENRY MORGENTHAU, JR., *Secretary*

PUBLIC HEALTH SERVICE
THOMAS PARRAN, *Surgeon General*

PNEUMONIA

Mortality and Measures for Prevention

Report of
Advisory Committee on Prevention of
Pneumonia Mortality

✦

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DIVISION OF SANITARY REPORTS AND STATISTICS

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It contains (1) current information regarding the prevalence and geographic distribution of communicable diseases in the United States insofar as data are obtainable, and of cholera, plague, smallpox, typhus fever, yellow fever, and other important communicable diseases throughout the world; (2) articles relating to the cause, prevention, and control of disease; (3) other pertinent information regarding sanitation and the conservation of the public health.

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FOREWORD

Since the earliest date that mortality figures became available in this country, pneumonia has appeared among the important causes of death. This high rate continues despite the fact that information concerning the disease is expanding very rapidly. The past three decades have witnessed an extraordinary increase in our knowledge of pneumonia. Careful bacteriological investigations have demonstrated the importance of the pneumococci in the causation of pneumonia; pneumococci have been classified into at least 30 different types; reasonably satisfactory, specific therapeutic serums have been developed for combating infections caused by several types of the pneumococci most commonly encountered; and, finally, experience has shown that serum therapy is adapted to the resources of the physician in general practice, irrespective of whether the patient is treated in his home or in a hospital.

A special committee of the United States Public Health Service met with the Surgeon General to review the present status of pneumonia work and to make recommendations regarding the measures that might be incorporated into public health programs. In this report, the Committee sketches the current pneumonia situation with respect to mortality and control programs in the United States, outlines the general and specific measures useful for combating the disease, and suggests methods for applying these measures on a much broader base than obtains at the present time. There is also a brief discussion of the problems on which further research is urgently needed.

Those parts of the report which deal with mortality, existing facilities, and programs now in operation were prepared in the Division of Public Health Methods of the National Institute of Health. The data on which these sections are based were taken from published reports of the United States Census Bureau, information supplied by State and local public health authorities, and hospital reports submitted to the American Medical Association. The appraisal of procedures and the course of action that is recommended express the views of the Committee.

The members of the Committee are as follows:

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PNEUMONIA

MORTALITY AND MEASURES FOR PREVENTION

I. Problem and Measures for Control

MORBIDITY AND MORTALITY

Case incidence.—Knowledge of the prevalence of a disease at all times is essential for its control. However, the scarcity of pneumonia case reports suitable for administrative use or for special studies presents specific and difficult problems. Pneumonia is a reportable disease in many States, but in none of the States does notification appear complete enough to give any indication of the true prevalence of the disease. So far as known, there is no State or city where an inclusive case reporting system is in operation which satisfactorily distinguishes the several types of pneumococcus pneumonia from pneumonia caused by other organisms. More important still, the term "pneumonia" does not refer to a single disease entity but covers a group of infections traceable to various etiologic agents. The pneumonias of greatest interest at the present time are those resulting from pneumococcus infections, and particularly those due to types of pneumococci against which effective specific therapeutic serums have been developed. Findings in a few scattered communities, chiefly located in eastern areas, indicate that Types I, II, III, V, VII, and VIII are those most frequently encountered.

No reliable information is yet available as to the absolute or relative prevalence of pneumococcus pneumonias in large civil population groups when viewed over long periods of time. Estimates based for the most part on data collected in eastern cities suggest that as many as two-thirds of all hospitalized cases may be due to pneumococci, but it is not known whether this holds true for those treated in homes or whether it is uniform throughout the country. Data also covering eastern States and more specifically the cities located therein suggest that 90 percent or more of lobar pneumonias and 50 percent of bronchopneumonias are of pneumococcus origin.

The International List of the Causes of Death classifies pneumonias as "bronchopneumonia," "lobar," and "unspecified," with various subclassifications, including "pneumococcal bronchopneumonia," "pneumococcus pneumonia" under "lobar," and "pneumococcus infection (unqualified)" under "unspecified." The latter terms, however, are seldom used on death certificates; thus current mortality

data based thereon give no indication as to what proportion, even of fatal cases, is due to pneumococci.

While adequate data are not available as to the number of cases of pneumonia that occur in the United States each year, considerable information on this point has been obtained through an enumeration of disabling illnesses known as the National Health Inventory. Preliminary tabulations of these data for a 12-month period during the years 1935–36 give an annual incidence of 558 cases of pneumonia (all forms) per 100,000 population. This survey, covering illness data on 2,602,000 persons in 83 widely separated cities and towns and 24 rural counties, shows that 14,525 of the individuals canvassed had had pneumonia during the 12 months preceding the survey, as a sole, primary, and/or contributory cause of sickness. The Health Inventory definitions of primary and contributory, though not identical with those used by the Census Bureau in classifying deaths, are nevertheless roughly comparable to them.

Case fatality rates now available are limited for the most part to the experience of certain hospitals. From such meager records, which are biased in many respects, one cannot draw conclusions regarding the proportion of cases which end in death.

Mortality rates.—It is recognized that the importance of pneumonia among the diseases of man is revealed only in part by reported deaths; but in the absence of a routine procedure for recording sickness experience, mortality data constitute the only recourse. The error inherent in stated causes of death is conceded, but with respect to primary pneumonia the gross mortality problem perhaps is revealed reasonably well, since under-reporting of deaths due to the disease in most forms is balanced by an excess of deaths that might rightfully be ascribed to other causes. The one common source of information on mortality is, of course, the United States Census Bureau.

For the 6-year period 1930–35, the Bureau of the Census reports an average of 96,500 deaths per year that are due primarily to pneumonia (all forms). This represents an average annual mortality rate of 77 per 100,000 population and places pneumonia in fifth position as a cause of death (fig. 1). Deaths reported for influenza are generally due to pneumonia; consequently the two diseases are often considered together. For the period 1930–35 the yearly mortality from these diseases was about 126,000, an annual death rate of 100 (fig. 1). The pneumonia-influenza group rivals cancer for second place among the causes of death. For purposes of simplicity in presentation, influenza is excluded throughout the remainder of the report from the figures pertaining to deaths and death rates. Likewise, no consideration is given to pneumonia as a secondary cause of death, although the Census tabulations for 1925 show that the inclusion of such figures would increase the mortality rate by nearly 50 percent.

The death rate for all forms of pneumonia is extremely high among children under 1 year of age and among adults 75 years of age and over (fig. 2). For all ages and for most age groups, the rate is higher

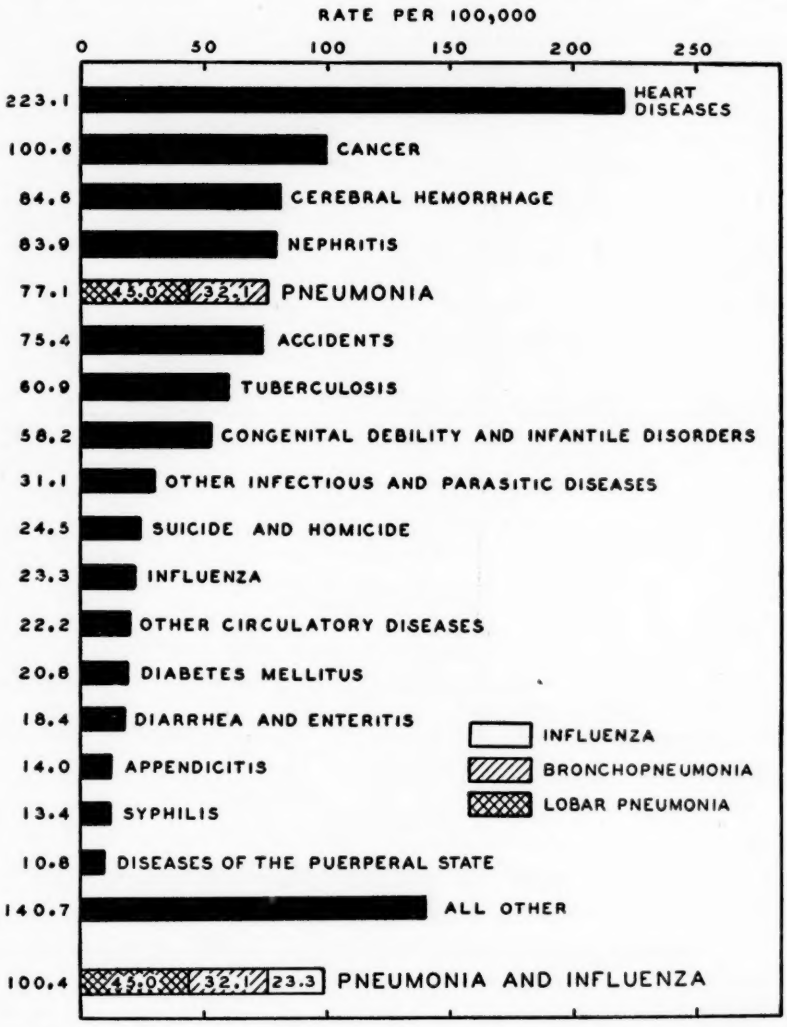

FIGURE 1.—Average death rates for selected causes of death, registration area, 1930-35. (Compiled from U. S. Census mortality reports.)

among males than among females, and twice as high among the colored as among the white population.

Among the unskilled workers, a group of relatively low economic status, the death rate for all forms of pneumonia is approximately three times that of professional and business men, the rates per 100,000 population being 161.6 and 55.8, respectively.[1] The rates

[1] Whitney, J. S.: Death rates by occupation. National Tuberculosis Association, New York, 1934.

for semiskilled workers (78.3) and for skilled workers (70.0) are also higher than for the professional and business group. All of these rates are based upon both white and colored males. Conceivably, the tendency for colored workers to be concentrated in unskilled occupations is partly responsible for the difference between the rate

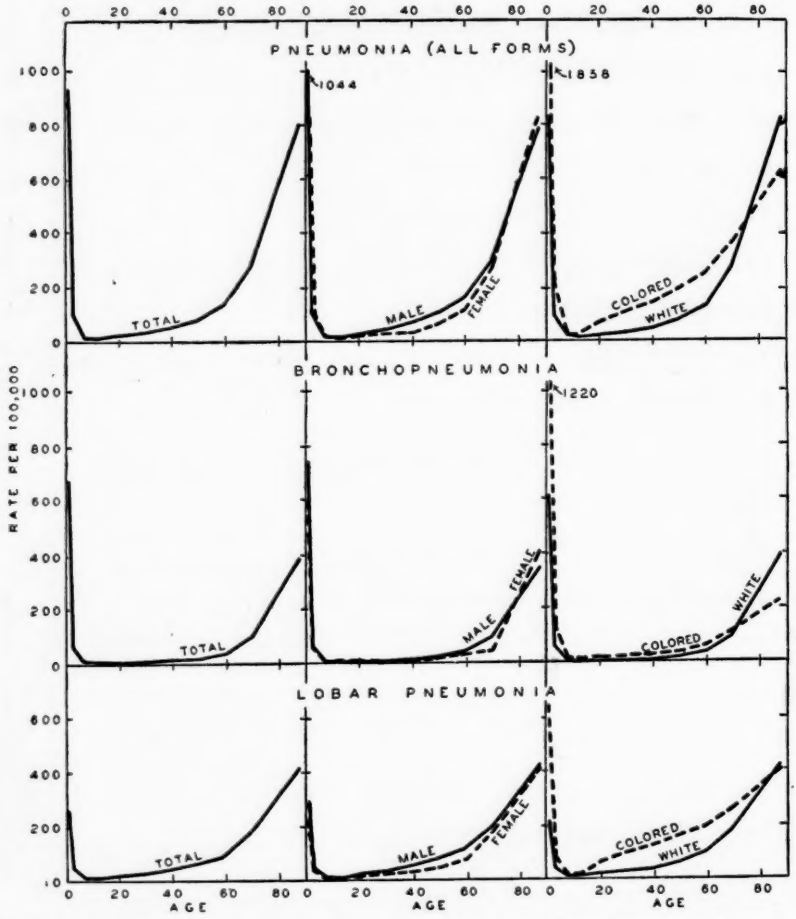

FIGURE 2.—Average age-specific pneumonia death rate by sex and color, registration area, 1929-31. (Compiled from U. S. Census mortality reports.)

of this group and that of the professional and business class. However, British studies which deal only with white males show relationships between pneumonia mortality and economic status that are essentially similar to those found in the United States.[2]

Excessive death rates for pneumonia occur among foundrymen, steel workers, firemen, bakers, miners, and manufacturing operatives, who often experience severe changes in temperature or are

[2] Britten, Rollo H.: Occupational mortality among males in England and Wales, 1921-1923. A summary of the report of the Registrar General. Pub. Health Rep., 43: 1565-1616 (June 22, 1928).

subjected to dusty working conditions; among masons, painters, and drivers of horse-drawn vehicles, whose occupations expose them to inclement weather; and among servants, waiters, janitors, and restaurant operators, who often work in poorly ventilated places.[3]

The role of bronchopneumonia and of lobar pneumonia as a primary cause of death during the period 1930–35 is expressed as an annual average in table 1. It will be seen that bronchopneumonia is reported to cause about 40 percent of the pneumonia deaths.

TABLE 1.—*Average annual number of deaths and average death rates for pneumonia of different forms—registration area, 1930–35*

[Compiled from U. S. Census mortality reports]

Form of disease	Deaths		
	Number	Percentage distribution	Rate per 100,000 population
Pneumonia, all forms	96,500	100	77
Bronchopneumonia	40,500	42	32
Lobar pneumonia	56,000	58	45

Reported deaths from both bronchopneumonia and lobar pneumonia occur with the greatest frequency among children under the age of 1 year and among adults 75 years of age and over (fig. 2). However, the death rate for bronchopneumonia among children in this age group greatly exceeds that for lobar pneumonia, while the lobar pneumonia rate for persons 75 years of age and over is larger than that for bronchopneumonia. In general, these age-group relationships also exist for persons of each sex, and for white and all colored populations.

To facilitate adjustment for age, a 3-year period centering around 1930, the year of the last census, was used for comparing regional mortality experience. During this period, 1929–31, the annual pneumonia (all forms) death rates of the 48 States average 84[4] per 100,000 population. They range from 124 for New Mexico, Arizona, and Maryland to 55 for Kansas (table 2). A number of States cluster around the average figure, but if the States are listed according to the size of their rates, Connecticut and Ohio are at the midpoint[5] between New Mexico and Kansas. Adjustment of the State rates for age alone does not materially change their respective positions. In no instance was it possible to correct the State rates for deaths of nonresidents.

[3] Whitney, J. S.: Op. cit.

[4] Simple arithmetic mean of the 48 State rates. The Texas rate is for 1933; this State was not in the registration area during 1929–31.

[5] The median States above and below which there are an equal number (23) of the 48 States when the States are arranged in the order of their rates.

TABLE 2.—*Average pneumonia death rate by States, 1929–31*[1]

[Compiled from U. S. Census mortality reports]

State	Pneumonia death rate per 100,000 population			
	All forms		Broncho	Lobar
	Crude	Adjusted[2]	Crude	Crude
United States	[3] 83.7	[3] 82.7	[3] 34.1	[3] 49.6
Highest one-fifth				
New Mexico	124.0	124.0	56.9	67.1
Arizona	123.7	127.4	58.7	65.0
Maryland	123.7	123.7	58.8	64.9
Nevada	123.0	110.9	43.9	79.1
Delaware	113.7	92.1	51.2	62.5
Rhode Island	107.9	106.8	37.8	70.1
Colorado	107.7	103.4	46.1	61.7
New York	102.7	106.8	41.5	61.2
Pennsylvania	101.6	103.6	40.0	61.6
Next to highest one-fifth				
Missouri	98.2	92.3	38.6	59.6
Massachusetts	96.6	92.7	51.1	45.5
South Carolina	92.5	103.6	24.0	68.5
Kentucky	91.6	81.5	35.8	55.8
Virginia	90.9	88.2	35.7	55.2
Tennessee	89.8	91.6	35.0	54.8
Vermont	89.8	74.5	35.6	54.2
New Jersey	87.2	92.4	32.7	54.5
Maine	85.7	71.1	38.3	47.4
Louisiana	84.78	92.4	36.1	48.7
Middle one-fifth				
Alabama	84.77	88.4	27.7	57.1
New Hampshire	84.5	67.6	37.0	47.5
North Carolina	83.3	88.3	29.7	53.6
Georgia	83.1	85.6	27.0	56.1
Connecticut	82.7	82.7	32.4	50.3
Ohio	80.9	78.5	38.4	42.5
Indiana	80.7	73.4	33.2	47.5
West Virginia	80.2	81.0	37.5	42.7
Montana	77.7	80.0	27.5	50.2
Arkansas	76.3	79.4	24.4	51.9
Next to lowest one-fifth				
Minnesota	76.0	73.8	37.2	38.8
Utah	75.0	76.5	35.0	40.0
Oklahoma	74.1	77.8	31.3	42.8
California	73.7	75.9	37.3	36.4
Illinois	73.5	75.0	31.0	42.5
Michigan	73.0	71.5	31.3	41.7
Mississippi	72.9	76.5	19.6	53.3
Wisconsin	70.9	65.9	30.3	40.6
Iowa	68.8	61.9	26.5	42.3
Idaho	66.5	67.2	26.1	40.4
Lowest one-fifth				
Wyoming	66.4	71.8	24.4	42.1
Texas [4]	65.4		27.0	38.4
Oregon	62.6	59.5	26.8	35.6
Nebraska	60.6	58.2	23.8	36.6
Washington	60.4	59.2	23.6	36.8
Florida	59.5	61.9	22.1	37.4
North Dakota	58.4	60.1	26.4	32.0
South Dakota	57.9	57.9	21.4	36.5
Kansas	54.7	50.3	24.4	30.3

[1] The period 1929–31 was selected because of the availability of accurate and detailed census population data for 1930. Although the period includes a part of the 1928–29 influenza epidemic, the order of the States with respect to their pneumonia mortality rates during the period 1929–31 is not materially changed thereby.
[2] Adjusted for age to 1930 population of registration area.
[3] Average of rates, i. e., simple arithmetic mean of 48 State rates.
[4] Texas rates are for 1933; this State was not in the registration area during 1929–31.

Most of the States in which the death rate for pneumonia is higher than the average are located in the southwestern, northeastern, and southeastern parts of the country (fig. 3). This fact, together with

the position of other areas having more favorable rates, indicates a regional distribution of pneumonia mortality and suggests a grouping of the States into five areas, each fairly uniform as to characteristics of population (table 3).

The high mortality in the Southwest may reflect the influence of immigration by persons with respiratory disorders and the presence of Indian and Mexican populations. In this connection, it is interesting to note the unusually high average rate for that fraction of the individual State populations living in cities of 10,000 to 100,000 in this region. The high rate for the Northeastern States is possibly

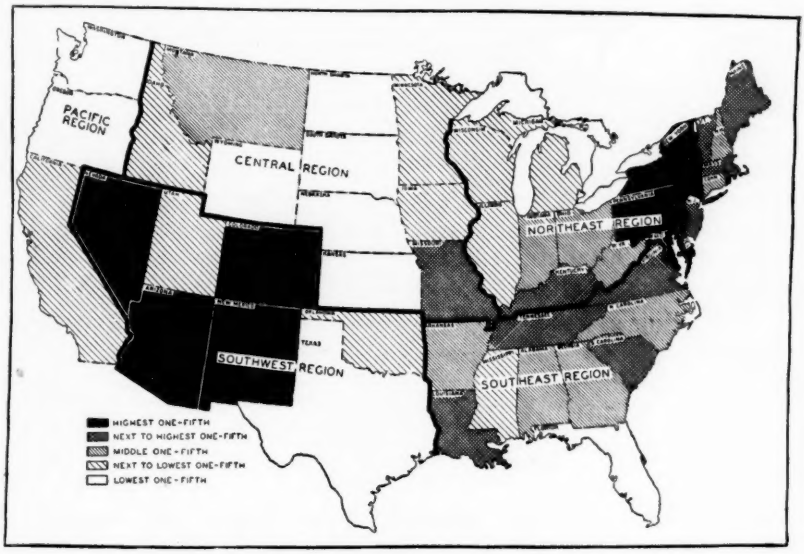

FIGURE 3.—Average pneumonia death rates by States, 1929–31. (Compiled from U. S. Census mortality reports.)

associated with the high mortality for those portions of the State populations residing in cities of 100,000 and over (table 3). The rate in the Southeast appears to be considerably influenced by the large Negro population.

Analysis of pneumonia mortality in those cities with 100,000 or more inhabitants in 1930 reveals an average annual pneumonia (all forms) death rate of 102 [6] during the years 1929–31 as contrasted with the corresponding State average of 106 as shown in table 3. The slight discrepancy between the two rates is due to the fact that the former represents an average of the individual rates for the several cities whereas the latter portrays the average of rates showing the mortality picture for "large city" populations in the several States.

[6] Simple arithmetic mean of the 93 city rates. These 93 cities represent the group which the 1930 census reported as having populations of 100,000 or over.

TABLE 3.—*Average State pneumonia death rate by urban character of place of residence and by geographic region, 1929–31*

[Compiled from U. S. Census mortality reports]

Region	Number of States	Average State death rate per 100,000 population residing in places of different urban character			
		Total	Cities of 100,000 and over [1]	Cities of 10,000 to 100,000	Cities of less than 10,000 and rural areas
United States	48	83.7	106.0	100.2	73.5
Northeast	18	90.4	117.4	[2] 89.4	78.2
Southeast [3]	10	81.8	116.7	111.1	72.1
Central	10	68.5	101.2	87.3	59.9
Southwest [4]	7	99.0	93.4	132.5	88.3
Pacific	3	65.5	72.1	73.2	61.6

[1] Averages for this group are based only upon the States having cities of 100,000 and over.
[2] This average is for 17 States only.
[3] The colored rate for the Southeastern States is 110.0 as compared with 68.5 for the white.
[4] The Texas rates are for 1933; this State was not in the registration area during 1929–31.

Among the cities of 100,000 and over, the rate of 217 for Pittsburgh is by far the highest, while the rate of 42 for Long Beach, Calif., is lowest (table 4). If the cities are listed according to the size of their rates, Kansas City, Kans., with a rate of 100, stands at the mid-point [7] between Pittsburgh and Long Beach. Adjustment for age alone does not materially alter the positions of the cities mentioned. With the information at hand it was not possible to correct the city rates for deaths of nonresidents. New York experience, however, indicates that such correction is not especially important in connection with pneumonia mortality.

TABLE 4.—*Average pneumonia death rate for cities of 100,000 and over, 1929–31*

[Compiled from U. S. Census mortality reports]

City	Pneumonia death rate per 100,000 population			
	All forms		Broncho	Lobar
	Crude	Adjusted [1]	Crude	Crude
All cities	[2] 101.8	[2] 99.7	[2] 43.9	[2] 57.9
Highest one-fifth				
Pittsburgh, Pa.	216.8	218.0	61.1	115.7
Baltimore, Md.	162.6	159.4	76.5	86.5
Camden, N. J.	151.7	152.6	59.8	91.8
Boston, Mass.	149.6	141.2	84.2	65.4
El Paso, Tex.	146.5	141.2	78.2	68.3
St. Louis, Mo.	144.6	140.5	50.6	94.1
Nashville, Tenn.	142.3	138.4	59.8	82.5
New Orleans, La.	139.3	142.5	70.6	68.7
Wilmington, Del.	138.8	134.1	54.4	84.4
District of Columbia	134.9	129.1	59.1	75.8
Providence, R. I.	134.8	125.6	45.1	89.7
Louisville, Ky.	132.6	124.2	61.4	71.2
Chattanooga, Tenn.	130.2	138.0	60.9	69.3
Jersey City, N. J.	127.9	133.2	55.0	72.9
Memphis, Tenn.	127.6	90.9	50.9	76.7
Birmingham, Ala.	127.1	140.2	34.3	92.8
Denver, Colo.	126.4	112.0	52.4	74.0
Gary, Ind.	125.5	145.2	43.8	81.7

[1] Adjusted for age to 1930 population of the 93 cities of 100,000 and over.
[2] Average of the rates, i. e., simple arithmetic mean of the 93 city rates.

[7] The median city above and below which there are an equal number (46) of the 93 cities when these cities are arranged in the order of their rates.

TABLE 4.—*Average pneumonia death rate for cities of 100,000 and over, 1929–31*—Con.

City	Pneumonia death rate per 100,000 population			
	All forms		Broncho	Lobar
	Crude	Adjusted	Crude	Crude
Next to highest one-fifth				
New Haven, Conn	124.8	119.3	44.3	80.5
San Antonio, Tex	124.4	123.7	49.7	74.7
Kansas City, Mo	124.3	120.8	56.3	68.0
Atlanta, Ga	123.5	135.2	43.6	79.9
Cincinnati, Ohio	123.2	111.4	48.5	74.7
Youngstown, Ohio	121.8	128.0	50.9	70.9
Elizabeth, N. J	119.6	126.1	49.7	69.9
Worcester, Mass	119.3	110.4	68.2	51.1
Trenton, N. J	119.2	117.9	48.6	70.6
Norfolk, Va	116.4	124.0	58.2	58.2
New York, N. Y	115.4	122.2	46.7	68.7
Utica, N. Y	115.0	105.2	60.0	55.0
Albany, N. Y	112.2	101.4	47.1	65.1
Indianapolis, Ind	110.9	103.5	50.5	60.4
Richmond, Va	109.9	112.0	47.6	62.3
Scranton, Pa	109.5	114.0	44.7	64.8
Newark, N. J	108.5	113.3	38.4	70.1
Cambridge, Mass	108.2	98.8	57.2	51.0
Bridgeport, Conn	107.7	106.9	46.4	61.3
Middle one-fifth				
Buffalo, N. Y	107.5	104.9	41.4	66.1
Cleveland, Ohio	107.3	115.3	56.5	50.8
Knoxville, Tenn	106.8	109.9	43.5	63.3
Spokane, Wash	106.5	96.3	31.2	75.3
Philadelphia, Pa	105.0	103.5	44.5	60.5
Hartford, Conn	104.2	102.8	44.5	59.7
Omaha, Nebr	102.8	96.9	38.3	64.5
Minneapolis, Minn	102.5	97.6	55.3	47.2
Oklahoma City, Okla	101.4	107.4	49.1	52.3
Kansas City, Kans	100.1	91.3	43.5	56.6
New Bedford, Mass	97.7	93.1	68.4	29.3
Paterson, N. J	97.5	95.0	32.5	65.0
Dallas, Tex	96.7	103.7	29.9	66.8
Springfield, Mass	96.7	91.4	44.7	52.0
Fall River, Mass	94.6	89.7	51.2	43.4
Lowell, Mass	93.8	83.4	70.8	23.0
Peoria, Ill	92.4	85.2	28.6	63.8
Syracuse, N. Y	90.8	83.7	34.4	56.4
Somerville, Mass	90.5	78.8	53.9	36.6
Next to lowest one-fifth				
Yonkers, N. Y	89.9	92.8	28.3	61.6
Jacksonville, Fla	88.8	96.7	29.3	59.4
Toledo, Ohio	88.7	85.0	33.7	54.4
Detroit, Mich	88.6	96.1	37.9	50.7
San Diego, Calif	86.4	69.4	35.1	51.3
Salt Lake City, Utah	86.3	82.2	37.8	48.5
Evansville, Ind	86.1	78.1	30.4	55.7
Columbus, Ohio	85.4	79.4	41.3	44.1
Fort Worth, Tex	84.4	89.4	33.7	50.7
South Bend, Ind	83.5	84.7	42.1	41.4
Des Moines, Iowa	82.8	76.9	34.4	48.4
Tulsa, Okla	82.8	91.0	27.6	55.2
Canton, Ohio	82.0	81.8	36.2	45.8
St. Paul, Minn	81.0	75.1	41.0	40.0
Chicago, Ill	80.6	84.3	35.1	45.5
Reading, Pa	80.1	79.4	35.1	45.0
Duluth, Minn	79.8	77.2	29.6	52.2
Erie, Pa	79.3	76.8	30.1	49.2
Wichita, Kans	78.3	74.1	35.1	42.3
Lowest one-fifth				
Houston, Tex	77.0	84.9	26.4	50.6
Rochester, N. Y	75.9	71.2	35.0	40.9
San Francisco, Calif	75.8	76.5	41.8	34.0
Portland, Oreg	75.2	69.9	33.8	41.4
Milwaukee, Wis	74.9	73.4	36.2	38.7
Fort Wayne, Ind	74.8	71.0	32.2	42.6
Lynn, Mass	73.3	65.2	29.3	44.0
Oakland, Calif	72.5	68.3	40.8	31.7
Flint, Mich	72.2	73.0	26.2	46.0
Dayton, Ohio	69.7	65.4	30.8	38.9
Akron, Ohio	69.0	74.0	32.2	36.8
Los Angeles, Calif	67.8	62.6	38.2	29.6
Seattle, Wash	62.9	60.2	25.4	37.5
Tacoma, Wash	60.9	55.3	27.2	33.7
Tampa, Fla	57.3	61.5	24.7	32.6
Miami, Fla	55.1	54.8	24.4	30.7
Grand Rapids, Mich	52.2	46.9	28.5	23.7
Long Beach, Calif	42.2	34.5	21.1	21.1

A great majority of the cities of 100,000 and over, whose death rates are higher than the average for the cities of this size, are located in the Southeast and Northeast (table 5). The picture with respect

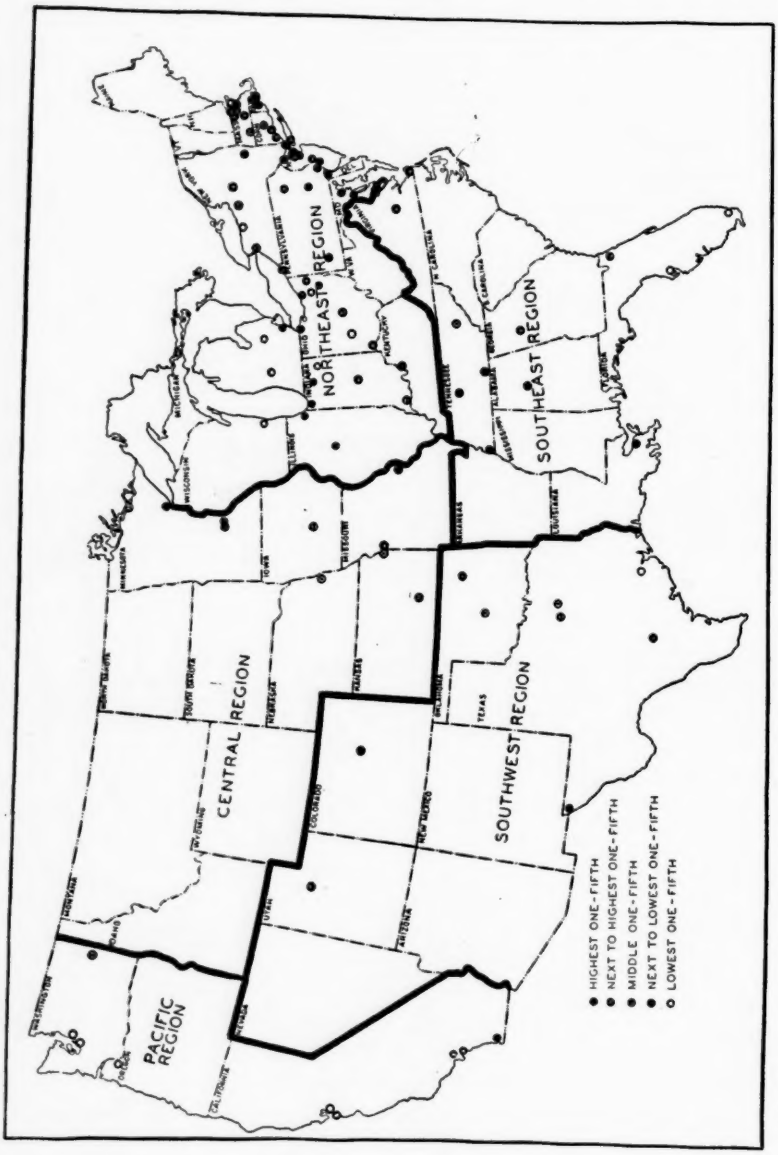

FIGURE 4.—Average pneumonia death rates for cities of 100,000 and over, 1929–31. (Compiled from U. S. Census mortality reports.)

to pneumonia mortality for the 93 cities having 100,000 or more inhabitants is shown in figure 4, wherein cities are grouped according to the regions used previously in presenting the mortality situation for the various States.

TABLE 5.—*Average city pneumonia death rate for white and colored by geographic regions, 1929–31*

[Compiled from U. S. Census mortality reports]

Region	Number of cities	Average city death rate per 100,000 population		
		Total	White	Colored [1]
United States	93	101.8	92.5	205.7
Northeast	54	105.1	98.6	251.8
Southeast	12	110.3	76.8	183.8
Central	9	99.6	95.7	218.5
Southwest	9	102.9	94.8	171.3
Pacific	9	72.2	71.5	99.9

[1] Averages of this group are for the cities of 100,000 and over for which the Census Bureau tabulates the deaths of colored persons separately.

EXISTING FACILITIES FOR DIAGNOSIS AND SERUM THERAPY

This section describes the extent to which health agencies of States and local political subdivisions, and also hospitals, have organized

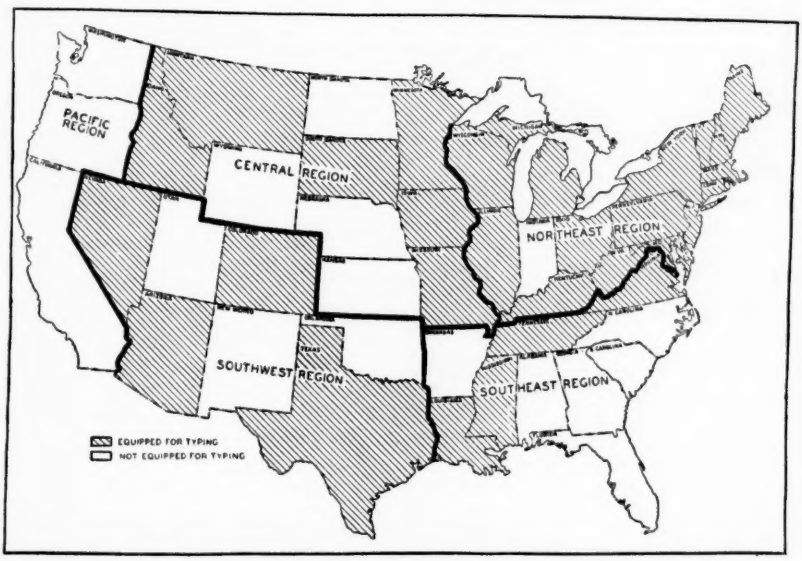

FIGURE 5.—Classification of States according to status of health department for typing pneumococci by Neufeld rapid method, 1937.

to combat pneumonia mortality. Bacteriological diagnoses and serum therapy are used as criteria, since these are basic items in any program and the ones on which information was sought. The term "facility" is used in preference to "program," since it is more descriptive of the data that were supplied.

Typing of pneumococci.—The health departments of 31 States have main or branch laboratories equipped for typing pneumococci by the Neufeld method. (See table 6 and fig. 5.) During 1936, 21 of these laboratories actually engaged in typing; they examined a total of 9,778 specimens. All but 1,073 of these typings were per-

FIGURE 6.—Classification of cities according to status of health department for typing pneumococci by Neufeld rapid method, 1937.

formed in the laboratories of three States, each of which had a State-wide pneumonia program. The health departments of 61 cities having 100,000 or more population reported Neufeld equipment for typing. (See table 7 and fig. 6.) Of the cities with such equipment the 39 which did typing examined a total of 9,227 specimens.

TABLE 6.—*Laboratory facilities of State health departments, equipment for pneumococcus typing, number of specimens typed, and number of positive reactions reported by States, 1936–37*

State	Pneumonia deaths, 1929–31		Typing facilities and activities of State health departments								
			Laboratories			Personnel		Specimens typed in 1936			
	Total number	Rate per 100,000	Total number	Typing by		Total number	Number typing [1]	Total number	Positive reactions		
				Neufeld	Other				Total	Type I	Type II
United States	103,074	[2] 83.7	147	103	68	1,236	209	9,778	6,207	1,187	336
(*Number of States*)	----	(48)	(47)	(31)	(21)	(47)	(27)	(21)	(20)	(16)	(17)
Highest one-fifth											
New Mexico	525	124.0	1	0	0	11	----	----	----	----	----
Arizona	539	123.7	2	1	0	5	0	----	----	----	----
Maryland	2,019	123.7	6	6	5	32	6	54	44	11	2
Nevada	112	123.0	1	1	0	4	1	4	4	0	1
Delaware	271	113.7	1	1	0	6	1	8	8	2	1
Rhode Island	742	107.9	1	1	1	5	2	74	74	2	1
Colorado	1,116	107.7	1	1	1	7	3	2	2	0	2
New York	12,930	102.7	32	32	29	513	88	5,766	3,591	733	89
Pennsylvania	9,783	101.6	1	1	0	40	1	3	3	1	0
Next to highest one-fifth											
Missouri	3,565	98.2	1	1	0	15	1	0	----	----	----
Massachusetts	4,104	96.6	1	1	1	11	5	1,446	896	189	52
South Carolina	1,609	92.5	1	0	0	9	----	----	----	----	----
Kentucky	2,396	91.6	1	1	1	6	0	----	----	----	----
Virginia	2,202	90.9	5	2	2	24	18	0	----	----	----
Tennessee	2,350	89.8	4	4	0	33	0	----	----	----	----
Vermont	323	89.8	1	1	0	6	1	160	63	8	0
New Jersey	3,523	87.2	1	1	1	26	3	5	2	1	1
Maine	798	85.7	2	2	0	5	5	56	41	10	16
Louisiana	1,782	84.78	7	4	3	19	9	2	2	0	2
Middle one-fifth											
Alabama	2,243	84.77	9	0	0	49	----	----	----	----	----
New Hampshire	393	84.5	2	1	0	3	2	12	12	2	3
North Carolina	2,640	83.3	1	0	0	[3]	----	----	----	----	----
Georgia	2,417	83.1	1	0	0	39	----	----	----	----	----
Connecticut	1,329	82.7	1	1	1	45	6	195	185	37	8
Ohio	5,381	80.9	1	1	1	36	2	----	----	----	----
Indiana	2,614	80.7	1	0	0	12	----	----	----	----	----
West Virginia	1,388	80.2	2	1	1	13	1	0	----	----	----
Montana	418	77.7	1	1	0	5	1	1	0	----	----
Arkansas	1,415	76.3	1	0	0	7	----	----	----	----	----
Next to lowest one-fifth											
Minnesota	1,950	76.0	4	4	1	[3]	6	0	----	----	----
Utah	381	75.0	1	0	0	6	----	----	----	----	----
Oklahoma	1,776	74.1	3	0	0	13	----	----	----	----	----
California	4,182	73.7	1	0	0	[3]	----	----	----	----	----
Illinois	5,614	73.5	4	4	2	23	4	18	11	1	1
Michigan	3,533	73.0	4	4	4	67	10	1,493	1,080	147	132
Mississippi	1,465	72.9	10	8	5	19	14	256	52	10	18
Wisconsin	2,083	70.9	9	9	1	40	10	195	109	26	6
Iowa	1,699	68.8	2	2	2	7	2	26	26	7	1
Idaho	296	66.5	4	4	4	[3]	5	2	2	0	0
Lowest one-fifth											
Wyoming	150	66.4	0	----	----	----	----	----	----	----	----
Texas [4]	3,941	65.4	1	1	1	24	2	0	----	----	----
Oregon	597	62.6	1	0	0	3	----	----	----	----	----
Nebraska	835	60.6	1	0	0	4	----	----	----	----	----
Washington	945	60.4	1	0	0	[3]	----	----	----	----	----
Florida	873	59.5	5	0	0	23	----	----	----	----	----
North Dakota	398	58.4	2	0	0	7	----	----	----	----	----
South Dakota	401	57.9	2	1	1	8	0	----	----	----	----
Kansas	1,028	54.7	2	0	0	6	----	----	----	----	----

[1] Information is not available as to actual time devoted to typing.
[2] Average of the rates, i. e., simple arithmetic mean of 48 State rates.
[3] No data supplied by reporting agency.
[4] Texas rates are for 1933; this State was not in registration area during 1929–31.

States and cities that did most of the typings in 1936 are located in the Northeastern section of the country, one of the three regions with high pneumonia death rates. In the other two regions with high death rates, the Southeast and Southwest, facilities were less generally available and typing by health departments was done infrequently.

TABLE 7.—*Laboratory facilities of city health departments, equipment for pneumococcus typing, number of specimens typed, and number of positive reactions reported by cities of 100,000 and over, 1936–37*

City	Pneumonia deaths, 1929–31		Typing facilities and activities of city health departments							
			Laboratories			Personnel		Specimens typed in 1936		
				Typing by					Positive reactions	
	Total number	Rate per 100,000	Total number	Neufeld	Other	Total number	Number typing [1]	Total number	Total	Type I	Type II
All cities	38,495	[2] 101.8	100	66	35	752	129	9,227	6,865	940	525
(*Number of cities*)		(93)	(91)	(61)	(32)	(91)	(51)	(39)	(35)	(34)	(33)
Highest one-fifth											
Pittsburgh, Pa.	1,452	216.8	1	1	0	10	2	6	0		
Baltimore, Md.	1,309	162.6	1	1	1	25	1	18	18	4	2
Camden, N. J.	180	151.7	1	1	0	3	2	0			
Boston, Mass.	1,169	149.6	1	1	1	9	3	20	20	0	1
El Paso, Tex.	150	146.5	1	1	0	2	1	0			
St. Louis, Mo.	1,189	144.6	1	1	1	22	1	13	[3]	[3]	[3]
Nashville, Tenn.	219	142.3	1	1	0	2	0				
New Orleans, La.	641	139.3	1	1	1	10	0				
Wilmington, Del.	148	138.8	1	1	0	3	1	0			
District of Columbia	658	134.9	1	1	1	6	1	4	4	2	1
Providence, R. I.	342	134.8	1	1	1	4	4	0			
Louisville, Ky.	408	132.6	1	0	1	13	4	0			
Chattanooga, Tenn.	156	130.2	1	0	0	4					
Jersey City, N. J.	405	127.9	1	1	1	4	1	75	75	39	18
Memphis, Tenn.	324	127.6	2	0	0	11					
Birmingham, Ala.	330	127.1	2	0	0	11					
Denver, Colo.	365	126.4	1	1	0	14	1	118	[3]	[3]	[3]
Gary, Ind.	126	125.5	1	0	0	[3]					
Next to highest one-fifth											
New Haven, Conn.	203	124.8	1	1	1	6	2	24	4	0	0
San Antonio, Tex.	288	124.4	1	1	0	3	0				
Kansas City, Mo.	497	124.3	1	1	1	24	2	260	260	11	29
Atlanta, Ga.	334	123.5	1	0	0	4					
Cincinnati, Ohio	556	123.2	1	1	0	4	1	1	[3]	[3]	[3]
Youngstown, Ohio	207	121.8	1	0	0	1					
Elizabeth, N. J.	137	119.6	1	0	0	3					
Worcester, Mass.[4]	233	119.3	1	1	0	6	2	266	266	26	17
Trenton, N. J.	147	119.2	1	0	0	1					
Norfolk, Va.	152	116.4	1	1	0	3	0				
New York, N. Y.	7,999	115.4	1	1	1	11	9	293	293	31	11
Utica, N. Y.	117	115.0	1	1	1	3	3	147	147	17	11
Albany, N. Y.[4]	143	112.2	1	1	1	25	10	382	223	51	4
Indianapolis, Ind.	404	110.9	1	1	0	2	0				
Richmond, Va.	201	109.9	1	1	1	21	[3]	0	0	0	0
Scranton, Pa.[4]	157	109.5	1	0	0	2					
Newark, N. J.	480	108.5	1	1	1	8	4	12	12	3	0
Cambridge, Mass.[4]	123	108.2	1	1	0	1	1	58	58	3	6
Bridgeport, Conn.	158	107.7	1	1	1	7	3	75	26	7	0
Middle one-fifth											
Buffalo, N. Y.	616	107.5	2	2	2	30	5	568	568	32	35
Cleveland, Ohio	966	107.3	1	0	0	19					
Knoxville, Tenn.	113	106.8	1	1	0	9	0				
Spokane, Wash.	123	106.5	1	0	0	3					
Philadelphia, Pa.	2,048	105.0	2	2	2	79	5	854	704	134	75
Hartford, Conn.	171	104.2	1	1	0	4	2	69	22	3	1
Omaha, Nebr.	220	102.8	1	1	0	3	1	0			
Minneapolis, Minn.	476	102.5	1	1	0	5	0				

See footnotes at end of table.

TABLE 7.—*Laboratory facilities of city health departments, equipment for pneumococcus typing, number of specimens typed, and number of positive reactions reported by cities of 100,000 and over, 1936–37*—Continued

City	Pneumonia deaths, 1929–31		Typing facilities and activities of city health departments								
			Laboratories			Personnel		Specimens typed in 1936			
				Typing by					Positive reactions		
	Total number	Rate per 100,000	Total number	Neufeld	Other	Total number	Number typing	Total number	Total	Type I	Type II
Middle one-fifth—Con.											
Oklahoma City, Okla.	189	101.4	1	0	0	[3]					
Kansas City, Kans.	122	100.1	1	1	0	1	0				
New Bedford, Mass.	110	97.7	1	0	0	2					
Paterson, N. J.	135	97.5	1	1	1	5	2	36	26	7	2
Dallas, Tex.	252	96.7	1	0	0	4					
Springfield, Mass.	145	96.7	1	1	0	1	1	0			
Fall River, Mass.	109	94.6	2	2	0	4	4	41	41	2	1
Lowell, Mass.	93	93.8	1	1	0	1	1	43	43	8	1
Peoria, Ill.[4]	97	92.4	1	1	1	8	4	67	67	[3]	[3]
Syracuse, N. Y.	190	90.8	1	1	1	16	6	1,943	1,180	100	11
Somerville, Mass.	94	90.5	1	0	0	2					
Next to lowest one-fifth											
Yonkers, N. Y.	121	89.9	1	1	1	10	6	174	146	23	3
Jacksonville, Fla.	115	88.8	1	0	0	[3]					
Toledo, Ohio	258	88.7	1	1	1	5	1	11	11	2	6
Detroit, Mich.	1,390	88.6	2	2	1	42	4	1,242	1,158	110	108
San Diego, Calif.	127	86.4	1	1	0	5	1	5	5	0	0
Salt Lake City, Utah	121	86.3	1	0	0	2					
Evansville, Ind.[4]	88	86.1	0								
Columbus, Ohio	248	85.4	1	0	0	6					
Fort Worth, Tex.	138	84.4	1	0	0	4					
South Bend, Ind.[4]	87	83.5	1	1	1	16	2	275	269	187	76
Des Moines, Iowa	118	82.8	1	0	0	2					
Tulsa, Okla.	117	82.8	1	0	1	3	0				
Canton, Ohio	86	82.0	1	0	0	1					
St. Paul, Minn.	220	81.0	1	1	0	4	0				
Chicago, Ill.	2,724	80.6	2	2	2	58	1	38	38	3	3
Reading, Pa.	89	80.1	1	0	0	3					
Duluth, Minn.	81	79.8	1	1	0	[3]	1	0			
Erie, Pa.	90	79.3	1	1	0	2	1	24	24	8	5
Wichita, Kans.	87	78.3	1	0	0	2					
Lowest one-fifth											
Houston, Tex.	225	77.0	[3]	[3]	[3]	[3]	[3]	[3]	[3]	[3]	[3]
Rochester, N. Y.[4]	249	75.9	1	1	1	23	5	1,773	967	88	86
San Francisco, Calif.	482	75.8	1	1	1	2	1	162	60	14	2
Portland, Oreg.	227	75.2	1	0	0	4					
Milwaukee, Wis.	432	74.9	1	1	1	6	1	0			
Fort Wayne, Ind.	86	74.8	1	1	0	1	1	0			
Lynn, Mass.	75	73.3	1	1	0	2	1	30	30	8	2
Oakland, Calif.	206	72.5	1	0	0	[3]					
Flint, Mich.	113	72.2	1	1	0	2	1	0			
Dayton, Ohio	140	69.7	1	0	0	4					
Akron, Ohio	176	69.0	2	1	0	9	0				
Los Angeles, Calif.	841	67.8	1	1	0	15	0				
Seattle, Wash.	230	62.9	1	1	1	6	1	2	2	1	0
Tacoma, Wash.[4]	65	60.9	1	1	1	4	2	12	12	2	2
Tampa, Fla.	58	57.3	1	0	0	2					
Miami, Fla.	62	55.1	2	1	0	6	5	20	20	0	4
Grand Rapids, Mich.[4]	87	52.2	1	1	0	14	4	66	66	14	2
Long Beach, Calif.	60	42.2	1	0	0	3					

[1] Information is not available as to actual time devoted to typing.
[2] Average of the rates, i. e., simple arithmetic mean of the 93 city rates.
[3] No data supplied by reporting agency.
[4] Does not operate own laboratory but depends upon contract arrangement.

According to the survey made by the American Medical Association, facilities for Neufeld typing are available in at least 1,757 hospitals. Their distribution by States is shown in table 8. A variation

was found among the States of from 16 to 65 percent in the queried hospitals reporting facilities for typing. Data are not at hand as to the number of typings carried out in these hospitals.

TABLE 8.—*Number of hospitals queried in each State and the number reporting facilities for typing pneumococci by the Neufeld rapid method*

[Compiled from unpublished data supplied by the American Medical Association, 1937]

State	Number of hospitals queried	Hospitals reporting use of Neufeld method		State	Number of hospitals queried	Hospitals reporting use of Neufeld method	
		Number	Percent			Number	Percent
United States	4,538	1,757	38.7	Montana	35	11	31.4
				Nebraska	68	16	23.5
Alabama	68	15	22.1	Nevada	5	1	20.0
Arizona	31	8	25.8	New Hampshire	32	12	37.5
Arkansas	49	10	20.4	New Jersey	126	60	47.6
California	246	94	38.2	New Mexico	29	11	37.9
Colorado	75	23	30.7	New York	428	239	55.8
Connecticut	54	35	64.8	North Carolina	127	30	23.6
Delaware	12	6	50.0	North Dakota	35	9	25.7
Florida	66	22	33.3	Ohio	189	75	39.7
Georgia	86	32	37.2	Oklahoma	98	25	25.5
Idaho	25	7	28.0	Oregon	39	15	38.5
Illinois	257	113	44.0	Pennsylvania	286	166	58.0
Indiana	100	47	47.0	Rhode Island	19	11	57.9
Iowa	116	22	19.0	South Carolina	43	9	20.9
Kansas	88	32	36.4	South Dakota	47	8	17.0
Kentucky	71	19	26.8	Tennessee	78	23	29.5
Louisiana	55	23	41.8	Texas	223	64	28.7
Maine	47	18	38.3	Utah	22	9	40.9
Maryland	62	20	32.3	Vermont	21	11	52.4
Massachusetts	193	84	43.5	Virginia	90	29	32.2
Michigan	169	70	41.4	Washington	80	36	45.0
Minnesota	142	55	38.7	West Virginia	67	22	32.8
Mississippi	67	11	16.4	Wisconsin	142	44	31.0
Missouri	111	47	42.3	Wyoming	19	8	42.1

Availability of therapeutic serum.—Information obtained from the 48 States shows that 10 State health departments have pneumonia programs; 13 more have projected definite plans; and 11 others are contemplating some activity (figs. 5 and 7). Among the 93 cities of 100,000 or more population, 24 are carrying out pneumonia programs; 16 have made definite plans for this purpose; and 5 others have the matter under consideration. Considerable difference exists in the extent of the programs that are being carried on by these State and city health departments, but all of them involve some serum therapy.

In some States and cities where pneumococcus serums are available for treatment of suitable cases, the material is supplied free to all patients on the basis of therapeutic need. In other communities the distribution of free serum is limited to indigent patients or to those for whom payment would impose a hardship; in still other areas serum is available at cost through the State health department only, and none is distributed free.

Information obtained from the 48 State health departments indicates that 2 of the 10 States with programs are producing therapeutic

pneumococcic serum for general distribution, and the other 8 are purchasing serum. As to the 93 cities having 100,000 or more population, 1 of the 24 with programs is producing serum and the remaining 23 are either purchasing serum or securing it from their respective State departments of health.

II. Effectiveness of Present Measures

PROPHYLAXIS

The views contained in this section express the composite opinion of the Committee with respect to various measures that might be

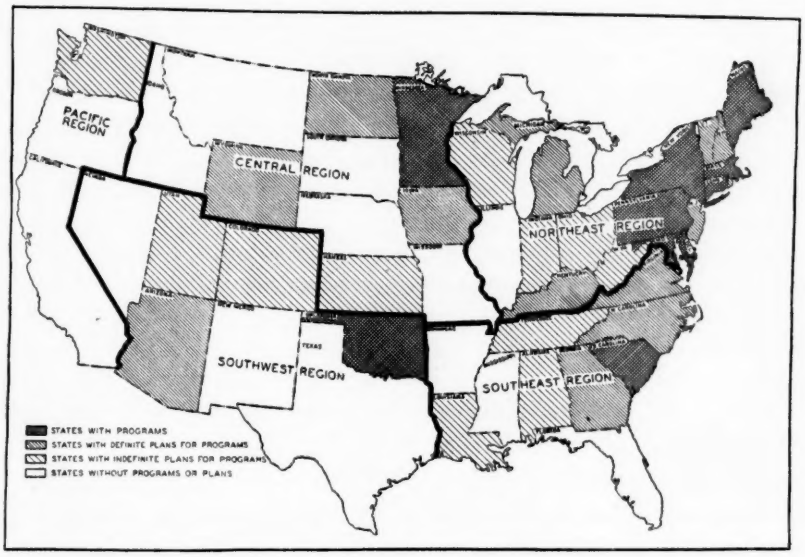

FIGURE 7.—Classification of States according to status of health department for pneumonia serum therapy, 1937.

incorporated into a comprehensive program for the reduction of pneumonia mortality. Though the value of certain of these procedures may not be generally accepted, they seem worthy of inclusion within the limitations herein set forth.

General precautions.—Possibly the commonest single predisposing factor in pneumonia is the presence of a mild upper respiratory infection in some form, such as the common cold. Individuals experiencing such infections should restrict their activities, avoid undue exposure, and refrain from excess of all types until their condition has improved. As already pointed out, high mortality from pneumonia is associated with exposure to certain unfavorable conditions, such as marked changes in temperature, inclement weather, and air laden with particular types of dust, especially silica-bearing dusts. These

conditions should be avoided, as they apparently influence not only the mortality but also the morbidity from pneumonia.

Quarantine.—Legal measures designed to restrict the movements of persons in contact with pneumonia patients are not likely to be effective since carriers are numerous as a rule before the clinical case develops. It is well, however, to be mindful of certain facts with respect to the epidemiology of the disease.

Pneumococci are known to be transmitted from person to person by clinical cases or by healthy carriers of infection. Epidemics of pneumococcus infection due to organisms of a single type have been reported among institutional and civil population groups. A limited amount of evidence is available to suggest that about 1 percent of the family contacts of pneumonia patients in the home develop the disease within a month after the onset of the initial case. Members of the family particularly, and occasionally other contacts, including physicians and nurses, may carry the type of pneumococcus infecting the patient. Individuals in contact with pneumonia cases due to agents other than pneumococci may also become carriers of the organisms responsible for the illness. In consequence, all pneumonia patients should be regarded as foci of infection. The evidence to date suggests that, on introduction into a household or institution, pneumococci of a given type may at times spread rapidly throughout the group, with the result that large numbers of exposed persons become carriers and a few develop clinical pneumonia. The number of visitors to patients, however, should be reduced to a minimum. This subject is discussed further in a succeeding section.

Active immunization.—Various substances have been used experimentally for active immunization against pneumonia, but up to the present time none of the products has been developed to the point where it might be recommended for general application.

MANAGEMENT OF CASE[8]

As stressed in various places throughout this report, proper care of the patient is the most effective measure at the present time for combating mortality due to pneumonia. The three primary essentials are bacteriological diagnosis, serum therapy, and nursing care. The several steps in caring for pneumonia patients are mentioned so that their importance may not be overshadowed by the emphasis on serum therapy.

Bacteriological diagnosis.—Since pneumonia may be caused by one of a variety of organisms, bacteriological methods offer the only

[8] Lord, F. T., and Heffron, R.: Pneumonia and serum therapy. The Commonwealth Fund, rev. ed. New York, 1938.

New York State Department of Health, Clinical aspects of pneumococcus pneumonia. Reprinted in N. Y. State J. Med., 37:80 (January 1, 1937).

Bullowa, J. G. M.: The management of the pneumonias. Oxford University Press, New York, 1937.

reliable means of classification. It is essential in pneumococcus pneumonia to determine which of the 30 or more different types is the causative agent and whether it is one against which an effective therapeutic serum has been developed. Routine procedures of choice in all cases of pneumonia include not alone sputum examination but blood culture as well. Pneumococcus typing has been greatly facilitated by the introduction of the Neufeld method, a rapid and comparatively simple test which can be performed in most cases without animal inoculation. While the Neufeld test can be done with limited equipment, skill and experience are necessary for its interpretation. Since time is an all important factor in the treatment of pneumonia, adequate diagnostic laboratory service within easy access of the physician is essential. In the larger communities at least, 24-hour laboratory service should be available.

Serum therapy.—The repeated inoculation of an animal with a given type of pneumococcus leads to the development within the animal of an immunity which is primarily specific for that particular type of pneumococcus, and the serum of the immunized animal has protective and curative action of a high order against the homologous organism. Therapeutic serums effective against certain types of pneumococci have been developed in accordance with this principle and have been found valuable in reducing pneumonia mortality among human beings. In fact, it was largely the accumulation of evidence showing the value of specific serum therapy which led public health officials to attack the pneumonia problem.

The sooner after the onset of the disease that serum is given, the better the prognosis. The fatality rate of cases where serum treatment is begun during the first or second day of illness is much lower than that of cases on which this mode of treatment is started later. It is well to remember, however, that occasionally serum may be of value even late in the disease.

Therapeutic pneumococcic horse serums of several types are now obtainable. The evidence available indicates that such serums are of value in the treatment of cases due to pneumococci of Types I, II, V, and VII, and possibly Type VIII. Subsequent additions to this list of the types against which serum is of value will doubtless be made. Therapeutic serum should be administered intravenously after precautions have been taken to avoid treating by this method patients who are especially sensitive to serum preparations.

The importance of determining whether or not bacteriemia is present cannot be overestimated because bacteriemia is one of the most important factors in influencing the prognosis. Patients with positive blood cultures should be given much larger serum dosages than those with negative blood cultures.

Complications.—During the clinical course of pneumonia distressing symptoms may arise that necessitate special treatment. Certain of these may be regarded as elements of the disease while others have the characteristics of intervening emergencies. In some instances the condition can be prevented or mitigated by appropriate care; on other occasions such unfavorable reactions may signify either massive infection or inadequate resistance on the part of the patient. The more common conditions that require special treatment are herewith enumerated, together with the more essential measures for meeting the situation.

For pleuritic pain, which often causes restlessness, such analgesics as aspirin or amidopyrine may be sufficient; a chest binder, rather than adhesive strapping, will help. For severe pain or troublesome cough, codeine or morphine can be used in repeated small doses. For high fever, with its accompanying restlessness, sponge baths are often effective. Adequate sleep is important and, in many cases, small, repeated doses of one of the barbiturates or the bromides will be found beneficial. Oxygen and drug therapy are occasionally valuable for delirium.

Abdominal distention is a common and often distressing occurrence. It is usually present in proportion to the degree of toxemia. The use of oxygen, and of serum, in suitable cases as well as attention to the diet often assists in reducing distention. A daily bowel movement is of value as a control measure. Other means for alleviating this condition include enemas, mild cathartics, stupes, the periodic use of the rectal tube, and at times pituitrin. In some cases despite all efforts abdominal distention will develop and, if severe, may add much to the gravity of the situation. The diet should be soft and bland. Liquids are more important than solid foods; the fluid intake should average about three liters (3,000 cc) a day during the acute stage of the illness. The addition of sodium chloride to the diet is helpful in preventing abdominal distention and excessive diaphoresis.

Oxygen inhalation is the most effective means of combating the cyanosis and dyspnoea of pneumonia. The common methods of oxygen administration are by means of chamber, tent, inhaler, and nasal catheter. The oxygen chamber is on hand in only a few hospitals. An oxygen tent is available in many hospitals or one may be rented in the locality. The most economical and readily available instrument for oxygen administration is the nasal catheter or the oxygen inhaler. Oxygen therapy must be regarded primarily as a supportive measure.

In some instances pneumonia offers an excellent example of what has been called "medical" shock. Circulatory failure is probably more commonly due to vasomotor paralysis than to heart failure. Collapse in pneumonia is combated along the lines of therapy in vogue

for the treatment of secondary surgical shock. The hypotension and reduction of effective blood volume may be treated by the intravenous injection of glucose solutions. Epinephrin is of value only for short periods in the treatment of shock. Strychnine and camphor are not used as extensively as formerly, but caffeine still finds favor with many physicians. The routine use of digitalis has not proved of value. Most authorities now recommend its use only in the presence of some preexisting cardiac incompetence, sudden irregularity, or other evidence of impending failure. The value of alcohol as a stimulant in pneumonia is open to question. Its general use is indicated only for patients who are chronic addicts.

General care.—Unfortunately, a large proportion of the persons attacked by pneumonia are found in the lower income groups and therefore are unable to finance proper care through their own resources. Since quality and quantity of medical care received may influence the outcome of the case, health officers and other public officials have a special responsibility in arranging for the necessary medical attention. Frequently care must be provided at public expense.

Current medical opinion and the results of special studies indicate that suitable nursing care may on occasions be a determining influence in the outcome of pneumonia. The provision of nursing care [9] can be regarded as an essential measure and one for which the use of public funds is justifiable. It is particularly desirable that patients treated at home be provided with it. A single home demonstration visit by a nurse may be of value when facilities do not permit a more intensive service.

Bed rest is the first essential in general care for the pneumonia patient. All physical and mental activities which draw on the energy of the patient must be eliminated. The sick room should be well ventilated, and the patient's comfort should determine the room temperature. There is no detail of treatment which cannot be carried out in the home, if adequate service is available, but in the large majority of instances the chances of receiving adequate care are better for patients in the hospital than in the home. The question of removing the patient to a hospital must, therefore, be settled individually in each instance.

The care of each patient should include those measures which have been found of value in the control of other communicable diseases. It is good technique to wash hands after examining or treating the patient and to disinfect concurrently all articles likely to convey infection. Wearing of gowns and masks by professional attendants and visitors is considered advisable by some authorities.

[9] New York State Department of Health. Handbook on the nursing care of pneumonia. Reprinted in N. Y. State J. of Med., 36: 1989 (December 15, 1936).

For the fullest possible measure of rest and quiet, the pneumonia patient, if at home, should be isolated in a room used for no other purpose than his care. Such provision should be made regardless of whether the patient is infected with pneumococci or with some other organism. Isolation of this nature may be of assistance in protecting the patient from cross infections; it may also aid to some extent, particularly with respect to children, in preventing the spread of organisms within the family group. To lessen the chance of cross infection and to restrict the spread of organisms, it is advisable that pneumonia patients in hospitals be isolated. Semi-isolation can be accomplished in wards by the use of cubicles.

Among the preparations of doubtful value in the treatment of pneumonia are vaccines and derivatives of quinine; pneumothorax and diathermy fall in the same class with respect to effectiveness. Sulfanilamide is still in the experimental stage as a therapeutic agent.

III. Conduct of State and Local Programs

Programs having as their ultimate purpose the reduction of pneumonia mortality have been developed on a State-wide or local basis. As has already been indicated, such programs are now in operation in many communities. The known results indicate that this work is worthy of support and that the extension of it over a wide area is essential before any great reduction of pneumonia mortality can be expected. Programs to be successful must enlist the active interest and cooperation of physicians, nurses, and laboratory and public health workers. The central purpose is to support and assist the practicing physician and make generally available to him facilities for the bacteriological diagnosis of the disease and specific serum for its treatment.

ORGANIZATION OF PROFESSIONAL RESOURCES

Experience has shown the necessity of developing sound cooperative pneumonia programs to obtain the maximum utilization of valuable information already at hand relating to pneumonia. The development of such programs requires the participation of all groups concerned with the health of the individual and the community, especially medical societies, and State, county, and city health departments. The medical societies may designate a pneumonia committee to cooperate with the other agencies concerned. It is essential that the health departments actively engage in this work especially by supplying the administrative facilities and such financial aid as may be needed. Wherever possible a pneumonia control unit should be established within the department, but at the least some individual within the organization must be responsible for the conduct of the general program.

The development and progress of a pneumonia program can best be assured by a general pneumonia advisory committee composed of representatives of the various interested professional groups. This committee might include elected or otherwise designated representatives of the medical society, health department, association of laboratory workers, and at times members of other related professional groups as well. The successful functioning of the advisory committee is of especial value in securing the necessary cooperation of professional groups and in the formation of a carefully prepared plan of pneumonia control designed to meet the needs of the individual community. The program outlined must be sufficiently flexible to allow alterations in procedure from time to time as the adoption of accepted new advances in the control of pneumonia becomes advisable.

Not all physicians are equally familiar with the new knowledge of pneumonia, and particularly with the technique of serum treatment. In order to extend the use of serum therapy the instruction of physicians by lectures, demonstrations, and other methods is desirable. As a means of satisfying their requests for assistance, several suitably trained physicians in various parts of the area may be designated as consultants.

Appropriate publicity among professional groups on matters relating to pneumonia is a necessary part of any plan. For this purpose the publication of articles in current medical journals, the distribution of circulars and pamphlets, and the use of charts, slides, moving pictures, and exhibits at medical meetings are of value. Graduate courses and symposiums on pneumonia at medical meetings have proved important means of acquainting physicians with the more recent developments in epidemiology and in clinical and bacteriological diagnosis, as well as with general medical and specific serum treatment. Arrangements may also be made to discuss various aspects of pneumonia at the meetings of State and county medical societies and similar organizations.

Nursing as well as medical agencies should be brought into the general scheme of organization. They, even more than physicians, are in need of information concerning recent developments in pneumonia diagnosis and therapy. The health department obviously will be most concerned with those nurses who are engaged in field service, especially among clients of health and welfare agencies. It is well to point out, however, that the program for preparing nurses for pneumonia work might be expanded to include both private duty nurses and those on the staffs of hospitals.

ESTABLISHMENT OF DIAGNOSTIC SERVICE

First and foremost, adequate facilities for bacteriological diagnosis, especially typing of any pneumococci found, must be generally avail-

able without charge to physicians. The laboratories undertaking this work need to be so spaced geographically as to facilitate rapid transmission by messenger of sputum and other material from suspected or recognized pneumonia patients. Some means is necessary for supervising or checking the bacteriological work done. In many instances special arrangements are needed for instructing laboratory technicians in the methods of pneumococcus classification. Identification should be carried out in the cooperating laboratories for as many of the known types as possible, but in every instance it should include those types for which specific therapeutic serums are available. As typing facilities and therapeutic pneumonia serums become available in the community, physicians need to be acquainted with the facts.

On every patient treated with pneumococcic serum a blood culture is indicated prior to serum administration and at intervals thereafter if the initial culture is positive, or the progress of the case is not satisfactory. The information thus obtained is usually of vital importance in gaging the total dose of serum required in a given case, and it furnishes valuable indications as to prognosis. To obtain a blood culture from a patient treated at home is often difficult without suitable equipment; consequently the furnishing of culture outfits which can be easily transported without contamination is a valuable type of assistance that might be expected from the health agency.

DISTRIBUTION OF THERAPEUTIC SERUM

Specific pneumococcic horse serum for Type I and serums for Types II, V, and VII, which the evidence at present suggests are clinically effective, should be made available for the treatment of suitable cases. Possibly Type VIII serum might be added to this list, although thus far there is less evidence of its value. Typing should always be done before administering the serum to insure that the serum is specific for the type of pneumococcus infecting the patient. These serums should be supplied at public expense to patients who are unable to pay for them or for whom such payment would be a hardship. The most marked saving of lives occurs when such serums are universally used; this requires that they be supplied without charge to needy patients. In return for the typing service rendered and the serum supplied, physicians should be required to fill out and send to some central office a record of each case treated.

Stocks of the specific therapeutic pneumonia serums might well be kept in hospital laboratories and places where typing is done. The establishment of too many depots of serum supply in a single locality is to be avoided, as it involves needless duplication of facilities and unnecessary added expense. With too many stations serum may be

stored until its period for use, as indicated on the label of the vial, has passed.

A sheet or circular giving directions for administering the serum should be prepared for distribution to physicians along with each package of the material. This may include information on the methods of testing for serum sensitivity and a description of the technique for obtaining a blood culture, as well as recommendations covering serum dosage and the treatment of any resulting untoward serum reaction.

In large-scale programs operated by health departments, therapeutic horse serum has been secured at a cost of approximately $35 for the average case of pneumococcus Type I pneumonia, and about $50 for the average case due to pneumococci of Type II. The figures at hand suggest that the cost of serum for the average case due to pneumococci of Types V, VII, or VIII is somewhere between these two figures. When commercial laboratories manufacturing serum are better able than they are at present to plan advance production schedules, a substantial lowering of the cost of serum per case should result. The certainty of a large and sustained demand for serum and the accumulation of more data on the incidence of the various types of pneumococcus pneumonia in the several regions of the United States would be of material assistance in attaining this desired goal.

INFORMATION FOR THE PUBLIC

The general public should be taught to recognize the early symptoms of pneumonia and be impressed with the necessity for calling a physician at the onset of any respiratory febrile illness. A certain amount of carefully prepared lay publicity is important. Addresses should be prepared for use at meetings of community groups. Material can very well be supplied for articles in newspapers or magazines, and for health exhibits and radio talks. Motion pictures are also useful. The importance of the proper care of colds and the great necessity for prompt medical assistance in the event symptoms or signs suggesting severe respiratory infection develop need to be stressed. The advantages of suitable nursing care and the fact that for some pneumonias an effective serum is available can be brought out. It is advisable that much emphasis be placed upon the need for providing pneumonia patients with proper medical care at the earliest possible moment in their illness.

IV. Recommendations for Research and Demonstration

In reaffirming its conviction that serum therapy has progressed to the point where its incorporation into public health programs is to be encouraged, the Committee is aware of the defects in scientific

information, the remedying of which would make control measures more effective and economical. Likewise there is necessity for a central agency to demonstrate to State and local health departments the most acceptable methods of conducting programs designed to reduce pneumonia mortality.

PERFECTION OF DIAGNOSTIC AND THERAPEUTIC SERUMS

Standardization of typing serums.—The classification of pneumococci into Types I, II, III, and Group IV by Dochez and Gillespie years ago, together with the more recent subdivision of the last group into some 28 additional specific types [10] by Cooper and her coworkers has afforded important means of attacking many of the problems presented by pneumonia. However, in dealing with many varieties of the same organism one might expect difficulties.

Because of changes in the biological characteristics of laboratory strains of these types and the varying response of animals to immunization with them, alterations in the specificity of diagnostic serums are not uncommon. Therefore, cross agglutinations and other confusing serologic reactions may appear during the preparation of these serums even though reasonable care is exercised.

As there are now several laboratories (State, city, and commercial) in this country producing diagnostic serums for varying numbers of the above-mentioned types of organisms, the chance of errors creeping into such work has been multiplied and the potential significance of these errors becomes very great. To safeguard progress thus far made, it is essential that all typing serums produced for use in this country, and elsewhere for that matter, be uniform as to their specificity. The Committee therefore recommends that adequate precautions be taken by some governmental agency, preferably the Public Health Service, to insure by suitable tests and other necessary means, the strict specificity of all diagnostic serums produced in or introduced into this country.

Standardization of stock cultures.—As an important corollary of the above work in standardization of typing serums, stock cultures should be maintained of each type of pneumococci for which diagnostic serum is available. Culture of any other pneumococci encountered might also be kept for study purposes.

Standardization of therapeutic serums.—Methods for standardizing the potency of therapeutic pneumococcic serums, for Types V, VII, and VIII especially, should be developed promptly and made uniform, as was done for Type I and Type II. Extensive application of specific serum therapy to diseases of Types V, VII, and VIII will be delayed

[10] Cooper considered Types VI and XXVI so much alike that she combined them and called the resulting types Type VI; in some instances this combination is referred to as Type VI (a) and (b). Recently other investigators have also regarded Types XV and XXX as similar. There is, however, no uniform agreement on this point.

as long as the potency of these serums cannot be uniformly measured and interpreted in terms of dosage. When suitable standards for these serums have been established, attention might be given to development of satisfactory potency tests for serums of other types, such as Types IV, VI, and XIV.

It would be desirable also to cooperate with the League of Nations' Committee on the standardization of biological products in an effort to arrive at reliable international potency standards for all pneumococcic serums used for therapeutic purposes.

As rapidly as potency standards are developed for therapeutic serums, steps should be taken to insure their observance by serum producers. It is desirable that these standards be made applicable to serums manufactured for sale or for free distribution. This matter might well be handled by the National Institute of Health.

Production of therapeutic serums.—Attention should be directed to improving the materials and the methods and schedules used when immunizing animals for antibody production. To facilitate such studies it would seem appropriate for the Public Health Service to give advice, technical assistance, and, where possible, financial aid to those public laboratories already engaged in the manufacture and distribution of pneumococcic serums. The success of such studies should be reflected in a higher antibody output per animal than obtains at the present time, with a lowering in the cost of serum.

There is also need for improving the methods of serum concentration and refinement. This problem might best be handled in those public laboratories already engaged in serum production, especially if they have access to clinical facilities where the efficacy of serum may be tried.

Antibody might well be studied further with a view to determining its chemical and physical characteristics. The possibility of synthetic antibody production or something approaching it always looms invitingly over the horizon.

If many States and large cities should promptly undertake to supply therapeutic pneumonia serums for all patients, or even for indigent patients within their jurisdictions, it is possible that a shortage of these products might develop. A survey should, therefore, be made of the potential output of therapeutic pneumonia serum by the various public and private laboratories producing this material. Such a survey might be repeated at regular intervals or when deemed necessary. Special attention should be given to the feasibility of reducing the cost of serums. The question of whether or not therapeutic serums should be purchased by the Federal Government and supplied at cost to various States and cities needs consideration. By such arrangement the cost of serums, at least certain types, might be substantially reduced below that prevailing at the present time.

FURTHER STUDY OF CHEMOTHERAPY AND IMMUNIZATION

Sulfanilamide.—The results thus far obtained from the therapeutic use of sulfanilamide in animals infected with pneumococci appear sufficiently impressive to warrant further investigation of the bactericidal power of this and related compounds. Whenever it seems advisable clinical trial of such substances, with or without the simultaneous administration of specific immune serum, should be made on a fairly extensive scale, with a control series for comparison. The use of clinical material in a single large hospital would probably facilitate studies, at least during the experimental period.

Felton's antigen.—The preliminary figures obtained as a result of the immunization of men in various Civilian Conservation Corps camps with derivatives of certain types of pneumococci, currently and inclusively referred to as Felton's antigen, suggest that this material may be of value for reducing the incidence of pneumonia among the immunized. This investigation should be continued and attention should also be given to the possibility of carrying out similar experimental immunization of selected civilian populations. It would seem advisable that both young and old adults be included, that the past pneumonia record of all members of the group chosen be known, and that careful record be kept, for at least six months after beginning the study, of all cases in the immunized and control groups. The populations under test should be such that the occurrence of all respiratory infections in both immunized and control groups could be determined. A necessary part of the project would be a clinical and bacteriological study of all cases. Certain antibody studies on the blood of individuals in the immunized and control groups would be highly desirable.

DETERMINATION OF THE CARRIER ROLE

Somewhat limited studies of normal persons have been made with respect to the carrier rate of pneumococci. The findings indicate that at a given time pneumococci of some type may be found in the nasopharynx of about 40 to 50 percent of normal people. The incidence of the carrier rate is known to increase during the colder months of the year. In addition, a very large proportion of normal people may at times during each year harbor some type of pneumococcus in the nose or throat. Most of the strains carried, however, are representative of those types least often found associated with pneumonia.

The findings obtained in a few studies of a small number of families suggest that when pneumonia due to one of the more virulent types, for instance Type I, occurs in an individual, about 20 percent of the other members of the patient's family are also carrying that same type of organism in their noses or throats. Where acute upper respiratory

infections, such as colds, are prevalent among the family contacts, the incidence of homologous type carriers may approach 70 or 80 percent.

The evidence to date suggests that pneumococci of a given type may be carried by one individual into the family group, where the organisms rapidly spread to several members. Occasionally one or more individuals within the group may subsequently develop a case of pneumonia due to that organism. If further observation demonstrates this to be a fact, it would do little good to insist upon strict isolation and quarantine in an effort to prevent spreading the organism to other members of the family, for many of the latter have already become carriers of the same type. Inasmuch as the mode of transfer may become the basis for administrative procedures aimed at controlling the prevalence of pneumonia, it is highly desirable that the question be studied further and that conclusive evidence be obtained as to the usual means by which infection is spread both inside and outside the family group.

A number of studies might be carried out in various parts of the country in which several thousand normal individuals would be examined periodically during the course of several months to determine the carrier rate for various types of pneumococci. The family contacts of a large number of typed cases of pneumonia might also be studied in similar fashion. In addition, it would be useful to determine the carrier rate of pneumococci in persons suffering from upper respiratory infections and among those having pathological conditions of the mouth, throat, nose, and accessory sinuses. Great practical importance attaches to factors which influence the carrier rate of pneumococci in both children and adults.

In recent years a number of outbreaks of pneumonia and other infections due to pneumococci of a single type have been studied in various institutions and in a few localities of this country. There are reasons for supposing that similar localized epidemics may occur with considerable regularity in institutions and small communities generally. It would be advisable to aid in initiating further studies of such outbreaks and, if possible, to determine means of preventing these epidemics. Outbreaks in institutions and small communities may be studied with profit, as very little is known about the natural history or usual course of epidemics of this nature. Some evidence has appeared suggesting that general immunization of the exposed population at the outset in institutional epidemics may be of use in aborting the outbreak. This matter needs further study. One of the additional problems encountered in efforts to prevent such epidemics is the difficulty of handling those healthy carriers who are harboring the type of pneumococcus responsible for the infections. Some attention might well be paid to means of curing or eradicating the carrier

condition in these individuals. The results of one or two studies of this problem in animals suggest that local treatment (washing the nose and throat with specific serum) plus parenteral administration of specific serum is of value in overcoming the carrier condition. The use of Felton's antigen or other immunizing agent for the necessary general treatment might be considered in conjunction with other measures.

IDENTIFICATION OF ETIOLOGIC ORGANISMS IN DIFFERENT REGIONS

Much more information is needed on the incidence of pneumonia due to various organisms including pneumococci. The true frequency of pneumococcus pneumonia, both primary and secondary, in large population units, has never been accurately determined. Arrangements might be made in several communities, preferably located in widely separated sections of the country, to set up special pneumonia incidence studies. Such a study might involve special reporting facilities whereby contact at intervals of a day or two would be made with every physician in the area. Over a period of 1, 2, or more years every case of pneumonia, both primary and secondary, in each area should be studied exhaustively from a bacteriological standpoint. Concurrent studies of pneumococcus carriers in the communities investigated would appear of great value. There is reason to believe that peculiarities of the host are important factors in the pathogenesis of pneumonia. More specific information on the nature and role of these factors is needed.

IMPROVEMENT OF MORBIDITY AND MORTALITY DATA

A statistical study should be made of the death certificates in which pneumonia is reported as a secondary cause to determine, if possible, differences in age, sex, occupation, and other factors associated with such deaths and those certified as being due primarily to pneumonia.

The Manual of the International List of Causes of Death, 1929, provides for the following classification, "108. Pneumonia lobar—pneumococcus pneumonia." The Instruction Manual of the Bureau of the Census, Department of Commerce, issued September 15, 1937, includes the following recommendation for coding: Page C 10—insert or correction—"Pneumonia types (I to IV) 108." It is suggested that the Bureau of the Census consider coding deaths from all types of pneumococcus pneumonia (I to XXXII) under "108. Lobar pneumonia," unless, in addition to the type, information is given that the death was from bronchopneumonia.

The current weekly State reports published in "Public Health Reports" do not include pneumonia. The weekly reports from cities

include pneumonia deaths but not cases. It is suggested that consideration be given to listing pneumonia cases in State reports, and pneumonia cases and deaths in city reports. Such a procedure might stimulate better case reporting. If necessary, in the interest of economy or convenience, pneumonia might be substituted for meningitis which now appears routinely in State and city reports.

SUPPORT OF FIELD PROGRAMS

Data presented earlier in this report, together with information known to Committee members, suggest that pneumonia programs tend to develop piecemeal and without particular pattern. In only a few geographic areas is the service comprehensive in character and under the direction of persons especially equipped for this type of work. Gradual extension of control measures may be expected under the present system, but meanwhile there will be a needless waste of lives. Without proper guidance of activities in the field, unfortunate experiences often are encountered and these tend to discourage the use of the newer diagnostic and therapeutic agents. To obviate further delay in the development of sound and comprehensive programs designed to reduce pneumonia mortality, the Committee urges that the resources of the Public Health Service be augmented and placed at the disposal of State and local health agencies. Assistance of the following types is recommended:

Periodic survey and appraisal of programs.—Once each year a complete inventory of State and local programs should be made. Information such as might be elicited by a questionnaire would suffice for the gross picture. More meticulous analysis and evaluation should be made of the experience in representative localities. The prompt publication of such findings will enable public health officials and practicing physicians to keep abreast with the advances that are being made.

Consultation service.—Because of popular demand, health officials are often forced to accept responsibilities for programs before the necessary personnel can be assembled and trained. Those who are available must meet the situation as best they can. This problem would be solved in part if there should be developed in the Public Health Service a staff to assist State and local health agencies with the several elements of a pneumonia program. Especially there is need of medical officers who are acquainted with the broader clinical and administrative aspects of the program. Not infrequently, however, the occasion may call for assistance in laboratory diagnosis or the production of serum.

Staff training.—As rapidly as possible staff members of the State and at least the larger local health organizations should acquire

particular skill in pneumonia work. Within each department not less than one physician, a nurse, and a laboratory technician should be given opportunity for special training. Inasmuch as laboratory diagnosis is the first element of a program to be perfected, it is suggested that particular attention be given to the training of technicians. The Public Health Service might suggest to the State health authorities that special consideration be given to the needs of pneumonia control workers when preparing budgets for training of personnel under provisions of the Federal Social Security Act. In certain sections of the country it may be necessary to set up training facilities in connection with universities or with selected health organizations.

Financial aid.—In addition to lending all possible encouragement and technical guidance to responsible groups wishing to start pneumonia programs, the Public Health Service might assist still further by suggesting that State health authorities allocate to pneumonia a portion of funds made available through title VI of the Social Security Act. It is recognized, of course, that sums now available through this source are not sufficient for more than limited demonstrations. Funds very much in excess of those now appropriated from all sources to Federal, State, and local health agencies are needed if any appreciable reduction in pneumonia mortality is to be effected through the use of serum therapy.

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